



# IT WILL BE AWESOME IF THEY DON'T SCREW IT UP:

3D Printing, Intellectual Property, and the Fight  
Over the Next Great Disruptive Technology

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# INTRODUCTION

## AN OPPORTUNITY, AND A WARNING

The next great technological disruption is brewing just out of sight. In small workshops, and faceless office parks, and garages, and basements, revolutionaries are tinkering with machines that can turn digital bits into physical atoms. The machines can download plans for a wrench from the Internet and print out a real, working wrench. Users design their own jewelry, gears, brackets, and toys with a computer program, and use their machines to create real jewelry, gears, brackets, and toys.

These machines, generically known as 3D printers, are not imported from the future or the stuff of science fiction. Home versions, imperfect but real, can be had for around \$1,000. Every day they get better, and move closer to the mainstream.

In many ways, today's 3D printing community resembles the personal computing community of the early 1990s. They are a relatively small, technically proficient group, all intrigued by the potential of a great new technology. They tinker with their machines, share their discoveries and creations, and are more focused on what is possible than on what happens after they achieve it. They also benefit from following the personal computer revolution: the connective power of the Internet lets them share, innovate, and communicate much faster than the Homebrew Computer Club could have ever imagined.

The personal computer revolution also casts light on some potential pitfalls that may be in store for the growth of 3D printing. When entrenched interests began to understand just how disruptive personal computing could be (especially massively networked personal computing) they organized in Washington, D.C. to protect their incumbent power. Rallying under the banner of combating piracy and theft, these interests pushed through laws like the Digital Millennium Copyright Act (DMCA) that made it harder to use computers in new and innovative ways. In response, the general public learned once-obscure terms like "fair use" and worked hard to defend their ability to discuss, create, and innovate. Unfortunately, this great public awakening came after Congress had already passed its restrictive laws.

Of course, computers were not the first time that incumbents welcomed new technologies by attempting to restrict them. The arrival of the printing press resulted in new censorship and licensing laws designed to slow the spread of information. The music industry claimed that home taping would destroy it. And, perhaps most memorably, the movie industry compared the VCR to the Boston Strangler preying on a woman home alone.

One of the goals of this whitepaper is to prepare the 3D printing community, and the public at large, *before* incumbents try to cripple 3D printing with restrictive intellectual property laws. By understanding how intellectual property law relates to 3D printing, and how changes might impact 3D printing's future, this time we will be ready when incumbents come calling to Congress.



Figure 1: 3D printers can create ball bearings in a single print. Image from Thingiverse user RayRaywasHere.

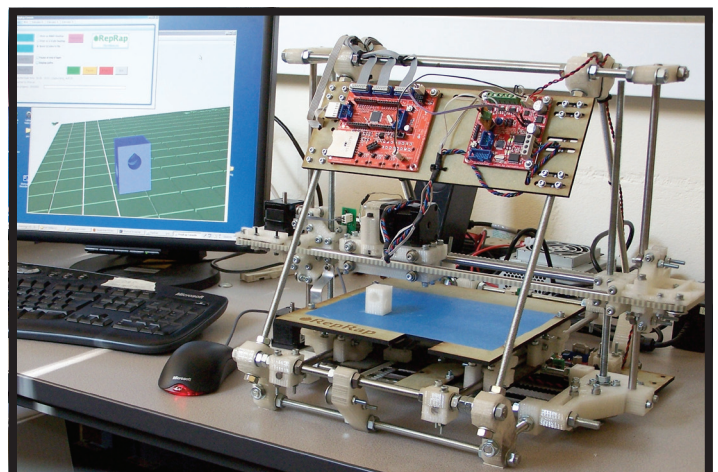
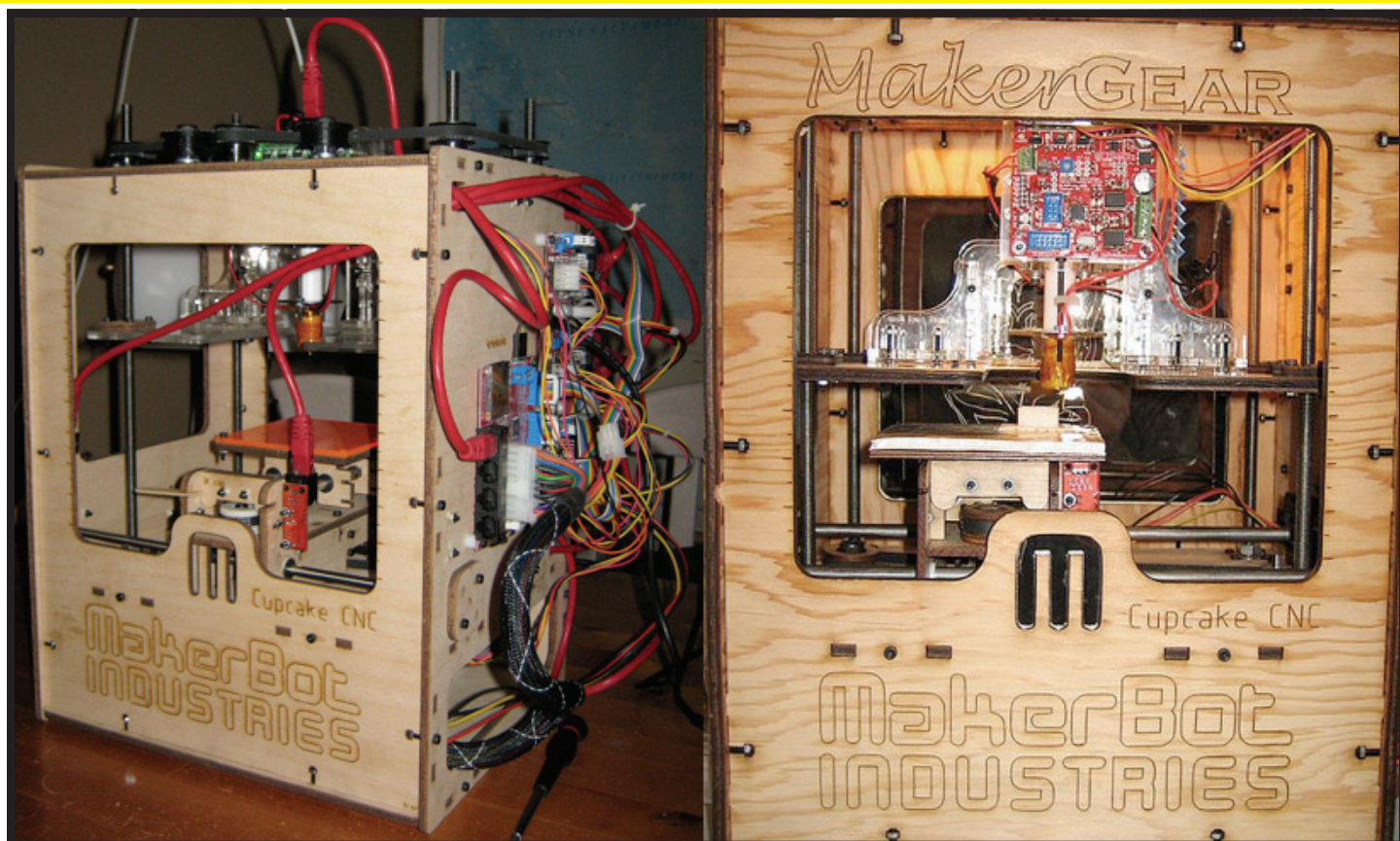


Figure 2: RepRap is an open source desktop 3D printer capable of replicating itself by printing all of the plastic parts necessary to build one. Image from RepRap.org.



*Figure 3: MakerBot Industry's Cupcake 3D printer is an open source 3D printer. It cannot reproduce itself, but it can create the parts necessary to build a RepRap. Image from MakerGear.*

### 3D PRINTING

So what is 3D printing? Essentially, a 3D printer is a machine that can turn a blueprint into a physical object. Feed it a design for a wrench, and it produces a physical, working wrench. Scan a coffee mug with a 3D scanner, send the file to the printer, and produce thousands of identical mugs.

While even today there are a number of competing designs for 3D printers, most work in the same general way. Instead of taking a block of material and cutting away until it produces an object, a 3D printer actually builds the object up from tiny bits of material, layer by layer. Among other advantages, this allows a 3D printer to create structures that would be impossible if the designer needed to find a way to insert a cutting tool into a solid block of material. It also allows a 3D printer to form general-purpose material into a wide variety of diverse objects.

Because they create objects by building them up layer-by-layer, 3D printers can create objects with internal, movable parts. Instead of having to print individual parts and have a person assemble them, a 3D printer can print the object already assembled. Of course, a 3D printer can also print individual parts or replacement parts. In fact, some 3D printers can print a substantial number of their own parts, essentially allowing them to self-replicate. See Figure 2.

3D printing starts with a blueprint, usually one created with a computer aided design (CAD) program running on a desktop computer. This is a virtual 3D model of an object. CAD programs are widely used today by designers, engineers, and architects to imagine physical objects before they are created in the real world. See Figure 4.



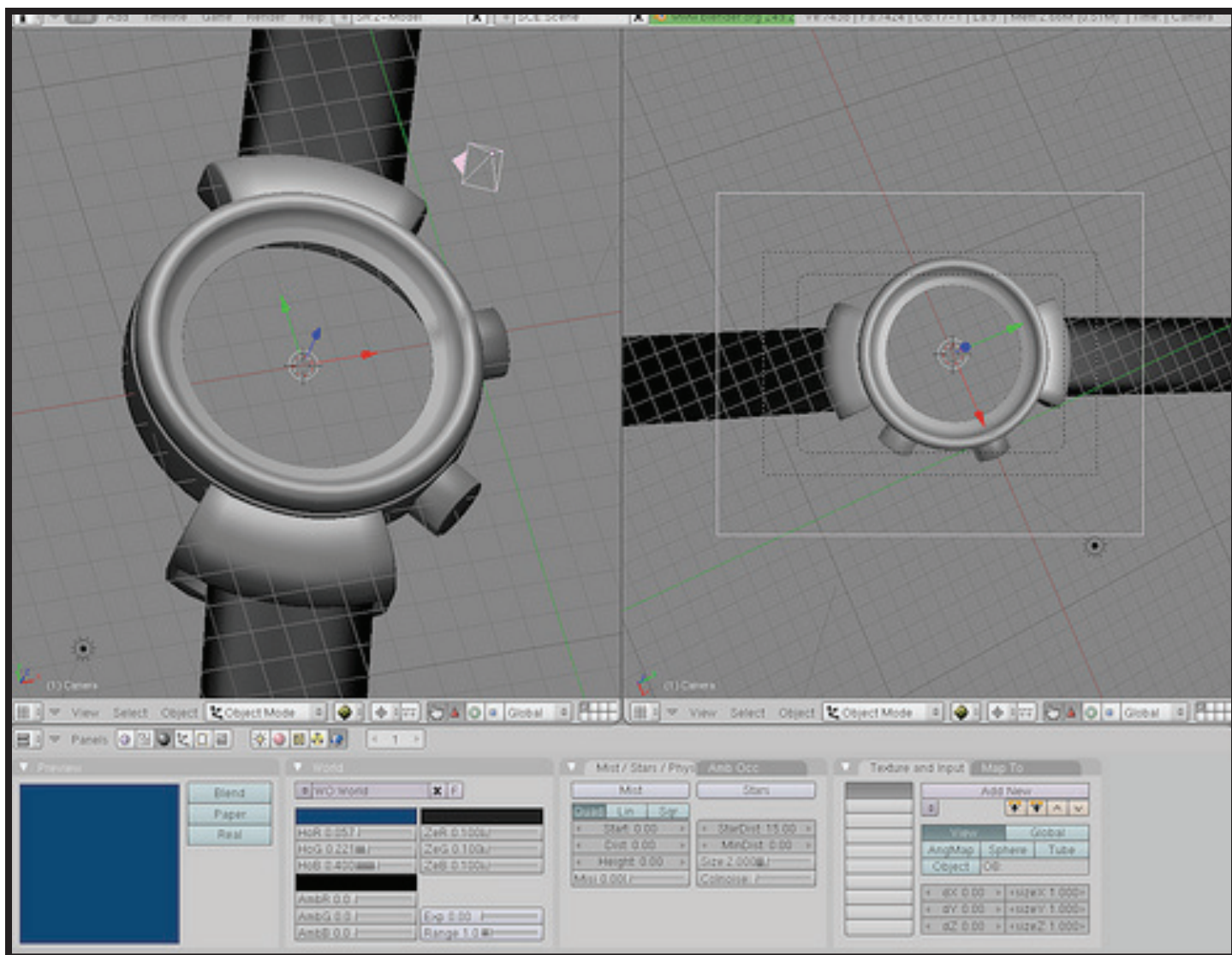


Figure 4: CAD programs range in price from thousands of dollars for proprietary versions made by companies such as Autodesk to this free and open source program called Blender. Image from Flickr user part 3.

The CAD design process replaces the need to design physical prototypes out of malleable material such as clay or styrofoam. A designer uses the CAD program to create the model, which is then saved as a file. Much as a word processor is superior to a typewriter because it allows a writer to add, delete, and edit text freely, a CAD program allows a designer to manipulate a design as she sees fit.

Alternatively, a 3D scanner can create a CAD design by scanning an existing object. See Figure 5. Just as a flatbed scanner can create a digital file of a drawing on a piece of paper, a 3D scanner can create a digital file of a physical object.

No matter how it is created, once the CAD design exists it can be widely distributed just like any other computer file. One person can create a new object, email the design to his friend across the country, and the friend can print out an identical object.

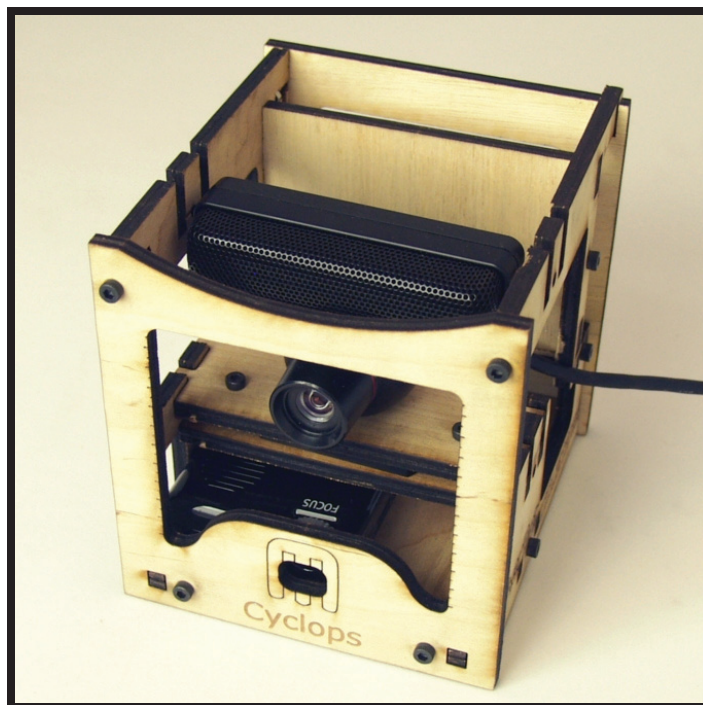
### 3D PRINTING IN ACTION

The mechanics of 3D printing are all well and good, but what can it actually be used for? This is a hard question to answer comprehensively. If in 1992, after describing the basics of computer networking, someone asked you what it could be used for, it is unlikely that you would have described Facebook, Twitter, or SETI@Home. Instead you may have described early websites like Craigslist, or the home pages of print newspapers, or (if you were particularly forward thinking) a blog. While these early sites are not representative of everything that today's maturing Internet has to offer, they do at least give someone an idea of what the Internet could be. Similarly, today's examples of 3D printing will inevitably appear primitive in five, ten, or twenty years. However, they can be helpful to understand exactly what we are talking about.

As mentioned above, 3D printing can be used to create objects. At its most basic, 3D printing would allow you to design bookends that look like your face, or even custom action figures. 3D printing could be used to make simple machines like bicycles and skateboards. More elaborately, when combined with on-demand circuit board printing, 3D printing could be used to make simple household electronics like a custom remote control for your TV that is molded to fit your hand, with all of the buttons exactly where you want them. Industrial 3D printing is already used to make custom, fully functional prosthetic limbs.<sup>1</sup>

This ability seems amazing today. Who could resist giving out exact replicas of their face to friends and family as gifts? What child (or adult, for that matter) would not enjoy the ability to summon toys they designed out of a computer and into their hands? What is to prevent you from making a toaster that squeezes into that oddly shaped nook in your kitchen? Why shouldn't amputees have prosthetic limbs that match the rest of their body, or that have neon stripes with alternating flashing lights if they so desire?

Yet, this amazing ability is also vulnerable to restriction through intellectual property law. Artists may fear that their copyright-



*Figure 5: MakerBot Industries sells a 3D scanner mount called Cyclops. Users need to supply their own projector, camera, and iPod touch or iPhone (or other VGA video source). Image from MakerBot.*

protected sculptures will be replicated without permission. Toy companies will see trademark and copyright violations in toys flowing from 3D printers. The new toaster or prosthetic arm may infringe on innumerable patents.

No one suggests that these concerns are unwarranted. After all, the ability to copy and replicate is the ability to infringe on copyright, patent, and trademark. But the ability to copy and replicate is also the ability to create, expand upon, and innovate. Just as with the printing press, the copy machine, and the personal computer before it, some people will see 3D printing as a disruptive threat. Similarly, just as with the printing press, the copy machine, and the personal computer, some people will see 3D printing as a groundbreaking tool to spread creativity and knowledge. It is critical that those who fear not stop those who are inspired.

<sup>1</sup> Ashlee Vance, 3-D Printing Spurs a Manufacturing Revolution, N.Y. Times, Sep. 13, 2010.

# USING 3D PRINTING

Intellectual property law is varied and complex, as are the potential uses for 3D printing. The easiest way to consider the possible impacts that intellectual property law could have on 3D printing is to consider a few different use scenarios.<sup>†</sup>

## CREATING ORIGINAL PRODUCTS

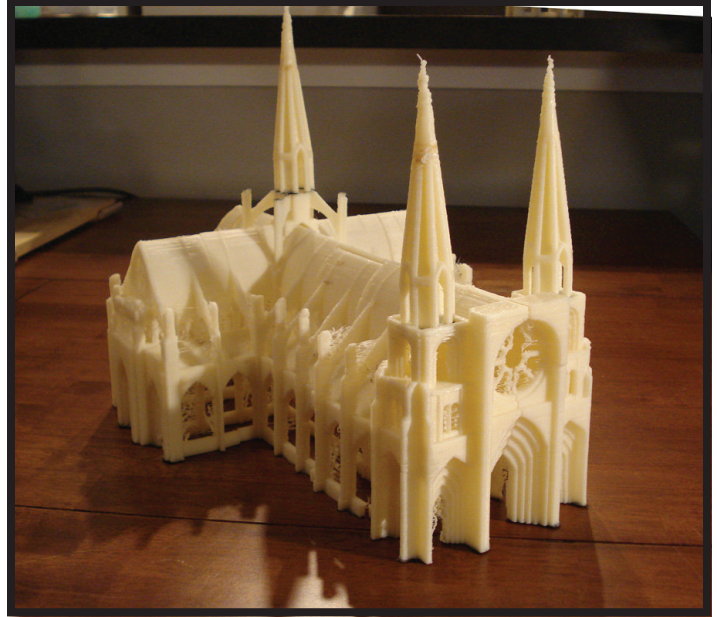
Intuitively, creating original products would create the fewest intellectual property conflicts. After all, the user is creating his or her own 3D object.

In the world of copyright law, this intuition is correct. When a child in Seattle writes an ode to his pet dog, that work is protected by copyright. If, two years later, another child in Atlanta writes an identical ode to her pet dog (unaware of the first ode), the second work is also protected by copyright. This is possible because copyright allows for independent creation, even if the same work was independently created twice (or even more than twice). While a work must be original in order to receive copyright protection, the work does not need to be unique in the world.

However, and relevantly for reproducing 3D objects, patent law does have a novelty requirement. Patent law does not allow for parallel creation. Once an invention is patented every unauthorized reproduction of that invention is an infringement, whether the reproducer is aware of the original invention or not.

Historically, this distinction has not been particularly problematic. Copyright protects many works that are long and complex, and can take the form of a variety of expressions. As a result, it was relatively unlikely that two people would create exactly the same work without the second copying the first. In contrast, many people working on a practical problem at the same time may create similar solutions. For patents to be worthwhile, they had to cover all identical devices, no matter how they were developed. It was assumed that parties vying for a patent were sophisticated and would do a patent search before trying to solve a problem. Everyone playing the game understood that it was a race to file, and took necessary precautions.

3D printing could change that. By democratizing the precision creation of physical objects, 3D printing may make the creation of physical objects nearly as widespread as the creation of copyright-protectable works. 3D printing also removes object creation from the realm of well-funded labs tightly integrated



*Figure 6: Thingiverse user Skimbal created this Gothic Cathedral Playset. He describes it as the "Mount Everest of MakerBot prints" because it pushes the limits of the technology's current capabilities. Image from Skimbal.*

into the existing patent system.

This shift will likely increase the number of innocent patent infringers – people who infringe on a patent they do not even know exists. As 3D printing proliferates, individuals will look to solve problems by designing and creating their own solutions. In producing those solutions it is quite possible that they will unwittingly incorporate elements protected by patent. Again, unlike copyright, that type of innocent copying is still infringement.

Sharing designs on the Internet amplifies the problem. It is unlikely that a single object produced for home use would attract the attention of a patent holder. But, if the history of the Internet up to this point has taught us anything, it is that people like to share. Individuals who successfully design products that solve real world problems will share their designs online. Other people with similar problems will use (and even remix and improve) those designs. Very successful designs that happen to infringe on patents are the most likely to be targeted by patent holders.

While this type of inadvertent patent infringement has the potential to become one of the high-profile, defining conflicts of early 3D printing, it is likely to impact relatively few people.

<sup>†</sup> This discussion is necessarily focused on United States law. For an excellent discussion of how EC and UK law apply, see S Bradshaw, A Bowyer and P Haufe, "The Intellectual Property Implications of Low-Cost 3D Printing", (2010) 7:1 SCRIPTed 5, <http://www.law.ed.ac.uk/ahrc/script-ed/vol7-1/bradshaw.asp>.



When millions of people are creating objects for 3D printing, the likelihood of someone copying a patented object or process is high. However, because patents do not cover most physical objects in the world, the likelihood that any one reproduced object infringes patent is relatively low. It is entirely possible that many (if not most) users of 3D printers will live their entire lives without inadvertently infringing on a patent.

## COPYING PRODUCTS

Naturally, every object produced in a 3D printer will not be the result of the printing individual's own creativity and ingenuity. As already mentioned, sometimes the object will be one downloaded and printed from another person's original design. However, sometimes the object will simply be a copy of an existing commercial product.

This copy could come from at least two sources. The first source would be the Internet. CAD plans, like all files, are easily copied and distributed online. Once one individual creates the plan for an object and uploads that plan, it is essentially available to the world. The second source would be a 3D scanner. A 3D scanner has the capability to create a CAD file by scanning a 3D object. An individual with a 3D scanner would be able to scan a physical object, transfer the resulting file to a 3D printer, and reproduce it at will.

No matter the source of the file, copying existing commercial objects will draw the attention of the object's original manufacturers. Although the proliferation of 3D printing will undoubtedly create opportunities for manufacturers (such as vastly reduced distribution costs and the ability to allow customers to customize objects), it will also disrupt existing business models. Depending on the type of object copied, manufacturers may turn to several different forms of intellectual property protection for relief.

## COPYRIGHT

Copyright essentially attaches to every original creative work that is fixed in a tangible medium.<sup>2</sup> This includes most things that are written, drawn, or designed. However, the copyright only protects the actual writing, drawing, or design itself, not the idea that it expresses.

Networked computers are designed to reproduce things that are written, drawn, or designed. Their spread created exponentially increasing public awareness of copyright law and policy. As creations appeared online, they have been copied. As items have been copied, creators and those who monetized scarcity have called for stronger, more aggressive copyright enforcement. Oftentimes they have sought to transfer the cost of enforcement onto service providers and the public – anyone but themselves.

In many ways, this struggle has defined the world of intellectual property law and policy for the last fifteen years. However, it has primarily been limited to the world of the intangible. The debate may manifest itself in a discussion about physical CDs, or DVDs, or books, but it really is about songs, and movies, and stories. These expressed ideas are at the core of copyright law.

The rise of 3D printing may divert some of the attention that copyright has received in recent years. While there are copyright implications for 3D printing, the fact that copyright has traditionally avoided attaching to functional objects – objects with purposes beyond their aesthetic value – may very well limit its importance.

By and large, attempts to expand copyright protection to functional objects have failed. Copyright law has long avoided attaching to functional objects on the grounds that patent law should protect them (if they should be protected at all). That said, it is unavoidable that some functional objects also serve the types of decorative and creative purposes protected by copyright. Copyright deals with this by applying the “severability test.”

<sup>2</sup> “Fixed in a tangible medium” is a term of art in copyright law, and a critical prerequisite for copyright protection. A work must be “sufficiently permanent or stable to permit it to be perceived, reproduced, or otherwise communicated for a period of more than transitory duration.” 17 U.S.C. § 101. In practice, this requirement distinguishes a speech made up on the spot and not written down (not fixed, and therefore not protectable under copyright) from a speech that is written down and then delivered (fixed, and therefore protected under copyright).

Classic useful articles (of the type traditionally covered by patent) are things like a new oil pump, or a hinge, or a machine to fold boxes. However, sometimes useful articles can also be decorative. A vase is a container to hold water and flowers, but it can also be a work of art in its own right. The severability test seeks to deal with the fact that sometimes an uncopyrightable object (the vase) and a copyrightable object (the decoration on the vase) can exist in the same object (the decorative vase). Under this test, any decorative elements of the object that exist outside of the scope of the useful object (or could be “severed” from the useful object) are protectable under copyright.

This has ramifications for individuals using 3D printers to reproduce physical objects. While, for the most part, the physical object itself will not be protected by copyright, decorative elements may be protected.

Users would be well served to keep this distinction in mind. Take, as a simple example, an individual who wishes to reproduce a doorstop. The individual likes this particular doorstop because it is exactly the right size and angle to keep a door in their home open. This doorstop also has decorative elements – it is covered with a lively and colorful print, and intricate designs are carved into the sides. If the individual were to reproduce the entire doorstop, including the print and carvings, the original manufacturer may be able to bring a successful claim for copyright infringement. However, if the individual simply reproduced the parts of the doorstop that he cared about (the size and angle of the doorstop), and omitted the decorative elements (the print and carving), it is unlikely that the original manufacturer would be able to successfully bring a copyright claim against the copier.

## PATENT

Patent is different from copyright in several key ways. First and foremost, patent protection is not granted automatically. While the mere act of writing down a story grants it copyright protection, the mere creation of an invention does not result in patent protection. An inventor must apply for a patent on her invention at the Patent and Trademark Office (PTO). The invention must be new,<sup>3</sup> useful,<sup>4</sup> and non-obvious.<sup>5</sup> In making the application, the inventor must disclose information that



*Figure 7: While the decorations on this vase would likely be protected by copyright, the shape is mostly utilitarian and therefore likely would not. Image from flickr user Hamed Saber.*

would allow others to practice the invention.<sup>6</sup> Finally, patent protection is significantly shorter in duration than copyright protection.<sup>7</sup>

The end result of these differences is that there are far fewer inventions protected by patent law than there are works protected by copyright law. While copyright law protects every ditty, every poem, and every home movie (no matter how trivial) for decades after its creation, most functional objects are not protected by patent law.

This dichotomy can be easily seen in the treatment of digital versus physical products. When you purchase a work that is delivered digitally to your computer, be it a song or a movie or a book, making additional unauthorized copies of that work is an infringement of it because it is protected by copyright (unless it

<sup>3</sup> See 35 U.S.C. § 101.

<sup>4</sup> See 35 U.S.C. § 102.

<sup>5</sup> See 35 U.S.C. § 103.



is in the public domain or the copy is a protected fair use). In contrast, when you purchase a physical object that is delivered to your home, making an additional copy of that object is unlikely to be a violation of patent because it is probably not covered by a patent. This creates an entire universe of items that can be freely replicated in a 3D printer.

Though patent protects fewer objects, and protects them for a shorter amount of time, in many ways it protects them more completely. As discussed above, there is no exception for independent creation in patent law. Once an object has been patented, all copies, regardless of the copier's knowledge of the patent, infringe upon that patent. Simply stated, if you are using a 3D printer to reproduce a patented object, you are infringing on the patent. Even using the patented device without authorization infringes on the patent. Furthermore, unlike in copyright, there is no fair use in patent. There is also no exception for home use, or for copying objects for purely personal use.

Yet, infringement is not as absolute as it might first appear. Infringement of a patented invention requires infringement of the entire invention. This flows from the nature of patents.<sup>6</sup> One of the primary requirements for patent protection is that the invention is new.<sup>7</sup> Often, a novel invention will consist of many existing inventions working together in a new way.<sup>8</sup> It would be illogical if, by patenting the new combination of old inventions, the patent holder acquired a patent on the old inventions as well. Therefore, copying unpatented parts of a patented invention is not a violation of the larger patent.

## TRADEMARK

Although it is usually grouped with patents and copyright, trademark is a slightly different intellectual property animal. Unlike patent and copyright, there is no mention of trademark in the Constitution. Instead, trademark developed as a way to protect consumers, giving them confidence that a product marked with a manufacturer's symbol was actually made and backed by that manufacturer. As a result, trademark is not designed to protect intellectual property per se. Intellectual property protection is instead a side effect of needing to protect the integrity of the mark.

Trademark could still be implicated when making exact copies of objects. If a 3D printer made a copy of an object and that copy included a trademark, the copy would infringe on the trademark. However, the specificity of 3D printing would allow an individual to replicate an object without replicating the trademark. If you like a given product, and do not feel passionately about having the logo attached to it, it will generally not be a violation of trademark law to reproduce it without the logo.

## Use in Commerce

There is an additional trademark issue to consider in the case of home-based 3D printing. Because trademark protection is specifically geared towards preventing consumer confusion in the marketplace, trademark infringement is described in terms of "use in commerce."<sup>11</sup> Unlike patent or copyright, it is not copying a trademark that creates a trademark violation. Instead, it is using that trademark in commerce (thus potentially confusing a consumer as to the origin of the product) that results in a violation.

Over time, the understanding of "use in commerce" has expanded significantly. Trademark infringement has even been expanded to include "dilution" of famous marks, essentially making any public use of a famous mark – in commerce or not – a violation of trademark law.<sup>12</sup>

That being said, the mere existence of an unauthorized trademark in your home is not a violation of trademark law. In most cases, making products in your own home for your own personal use that include trademarks is not a violation of trademark. You know you made the product, so there is no chance that you are going to be "confused" about where it came from.

However, this does not mean that just because you make a product in your home there are not trademark implications. Using a home 3D printer to churn out knockoff sunglasses to use in your back yard may not be trademark infringement, but it will be as soon as you take steps to try and sell them.<sup>13</sup>

<sup>6</sup> See 35 U.S.C. § 112.

<sup>7</sup> See 35 U.S.C. § 154 (a)(2).

<sup>8</sup> See *Bullock Electric & Mfg. Co. v. Westinghouse Electric & Mfg. Co.*, 129 F.105, 109-10 (C.C.A.6 1904).

<sup>9</sup> See 35 U.S.C. § 101.

<sup>10</sup> See *Leeds and Catlin Co. v. Victor Talking Machine Co.*, 213 U.S. 301, 318 (1909).

<sup>11</sup> 15 U.S.C. § 1114.

<sup>12</sup> See 15 USC § 1125(c).

<sup>13</sup> Or, if the trademark is considered appropriately famous, as soon as you wear them in public.

## REPLACEMENT OBJECTS

While 3D printing could be used to create wholesale copies of manufactured goods, it could also be used to create replacement parts for worn or broken goods. Instead of scouring the Internet for that oddly shaped bracket or hinge, an individual could simply print out a perfect replacement part. In fact, the individual might decide to improve upon the original part to prevent it from breaking in the future.

As with creating and copying objects, there are ways in which manufacturers could use intellectual property law to prevent such activity. In the case of replacement objects, copyright and trademark protections will not be as important. A replacement part is, almost by definition, a “useful article” of the type under the jurisdiction of patent law.

Patent allows for the free reproduction of replacement parts in a number of ways. First, there are relatively stringent requirements for patent protection. As mentioned above, these stringent requirements mean that relatively few objects are protected by patent.

Moreover, many of the objects protected by patent are, in fact, “combination” patents. Combination patents combine existing objects (some patented, some not) in a new way. Although the new combination is protected by patent, the individual elements (assuming they are not individually protected by patent) are free to be reproduced at will. As a result, there is little question that manufacturing unpatented replacement parts for a patented device would not violate the patent for that device.<sup>14</sup> As long as you legitimately purchased the original device, you have the right to manufacture your own replacement parts.<sup>15</sup>

This right to replace has two noteworthy caveats. First, you only have the right to replace parts of a patented device. That means that a simple patented device consisting of only one part, or an individually patented part of a more complex device, cannot be reproduced without infringing.

Second, though repairing a patented device is legal, reconstructing the same device in its entirety from its constituent parts is infringement.<sup>16</sup> The line between repair and reproduction is somewhat undefined, and may become an area of increased attention as the use of 3D printing to replace parts expands. A good rule of thumb is that if the patented item is designed to be used once, attempting to refashion it would qualify as infringement.<sup>17</sup> If, however, there is an unpatented part of a larger patented device that has worn out, refashioning the part is not infringement.<sup>18</sup> This holds true even if, over time, the owner of a device ends up replacing each worn out part of the patented device.<sup>19</sup> Alternatively, replacing part of a patented device in order to give the device new or different functionality is also not infringement, because it creates a new device.<sup>20</sup>

## USING LOGOS AND OTHER TRADE DRESS

Once they become widespread, individuals will begin using 3D printers to reproduce trademarked logos and other elements of “trade dress.”<sup>21</sup> Most exact logo reproductions, as discussed above, will likely be infringement. The look and feel of the object, often referred to as “trade dress,” is slightly more complex. Those aspects can be protected by design patent and by the trade dress subsection of trademark.

## DESIGN PATENTS

In addition to purely functional patents, United States law also provides patent protection for “new, original, and ornamental design for an article of manufacture.”<sup>22</sup> Although this expansion into ornamental design might appear to overlap with copyright, design patents are quite limited in scope.

First, the protected design must truly be novel.<sup>23</sup> Secondly, design patents are strictly limited to ornamental, non-functional designs.<sup>24</sup> Courts have reacted skeptically when manufacturers have attempted to use design patent to protect functional elements of designs.<sup>25</sup> Finally, the design protection itself only extends to the actual design represented in the patent application, not similar designs or designs merely derived from the original.<sup>26</sup>

<sup>14</sup> See *Aro Mfg. Co. v. Convertible Top Replacement Co.*, 35 U.S. 336, 344 (1961) (Aro I).

<sup>15</sup> See *Aro Mfg. Co. v. Convertible Top Replacement Co.*, 377 U.S. 476, 480 (1964) (Aro II).

<sup>16</sup> See *Husky Injection Molding Sys. Ltd. v. R & D Tool & Eng'g Co.*, 291 F.3d 780, 785 (Fed.Cir. 2002).

<sup>17</sup> *Id.*

<sup>18</sup> *Id.* at 785-86 (quoting *Aero I*).

<sup>19</sup> *Id.* at 786.

<sup>20</sup> *Id.*

<sup>21</sup> Trade dress is a subsection of trademark law. A classic example of protectable trade dress is the curvy Coca Cola bottle (as opposed to the protectable trademark of “Coca Cola” written in its distinctive cursive script printed onto that bottle).

<sup>22</sup> 35 U.S.C. § 171

<sup>23</sup> See *id.*

<sup>24</sup> See *Best Lock Corp. v. Ilco Unican Corp.*, 94 F.3d 1563, 1566 (Fed. Cir. 1996).

<sup>25</sup> See *id.*

<sup>26</sup> See *id.* at 1567.

In many ways this distinction between form and function clashes with the traditional goals of industrial design. In general, industrial designers achieve elegance by wedding form to function – finding a single way to meet both imperatives. Creating a hard distinction between form and function runs counter to that goal.

In any event, users of 3D printers should often be able to work around design patents. If an element of an object is functional, and thus necessary to reproduce a machine or product, it simply cannot be protected by a design patent.<sup>27</sup>

However, there are some cases in which design patent protection may be problematic. Perhaps most famously, automobile manufacturers are increasingly using design patents to protect body panels, lights, and mirrors. This has allowed them to prevent third parties from entering the auto replacement parts market.<sup>28</sup> Also, design patents can be used to protect designs as soon as they enter the marketplace. This can give manufactures the ability to protect a design during the time it takes to develop the secondary meaning required to obtain more permanent trade dress protection under trademark law.<sup>29</sup>

### TRADE DRESS

Trademark protection can extend beyond a logo affixed to a product to include the design of the product itself. However, in order to extend protection to product design, courts have required that trade dress acquire a distinct association with a specific manufacturer.<sup>30</sup> Acquiring this type of distinctiveness takes time, and must be proven by survey results or some other proof of association in the eyes of the general public. As a result most product designs, even unique designs intended “to render the product more useful or more appealing,” will not be protected as trade dress.<sup>31</sup>

Additionally, as with design patents, trade dress protection cannot be applied to functional product elements.<sup>32</sup> The burden of establishing nonfunctionality of the trade dress lies with the manufacturer, making it harder to protect functional



*Figure 8: While the Coca Cola script logo is protected by trademark, the look and feel of the classic Coke bottle is protectable under trade dress. Image from flickr user KB35.*

elements behind trade dress.<sup>33</sup> Any “essential” feature of a product – a feature that would put competitors at a “significant nonreputational-related disadvantage” if they were unable to incorporate it, or would affect the cost or quality of the device – is excluded from trade dress protection.<sup>34</sup> As the Supreme Court wrote, trademark law “does not protect trade dress in a functional design simply because an investment has been made to encourage the public to associate a particular functional feature with a single manufacturer or seller.”<sup>35</sup>

<sup>27</sup> See *id.* at 1566.

<sup>28</sup> See Design Patents and Auto Replacement Parts: Hearing Before the H. Comm. On the Judiciary, 111th Cong. (2010).

<sup>29</sup> Daniel Brean, *Enough is Enough: Time to Eliminate Design Patent and Rely on More Appropriate Copyright and Trademark Protection for Product Design*, 16 Tex. Intell. Prop. L.J. 325, 364 (2008).

<sup>30</sup> Although simple trade dress can be “inherently distinctive” from the moment it enters the marketplace, product design trade dress cannot be inherently distinctive and must acquire distinctiveness. See *Wal-Mart Stores, Inc. v. Samara Brothers*, 529 U.S. 205, 215 (2000).

<sup>31</sup> *Id.* at 213.

<sup>32</sup> See *Traffix Devices v. Mktg. Displays*, 532 U.S. 23, 29 (2001).

<sup>33</sup> See *id.* at 33.

<sup>34</sup> *Id.*

<sup>35</sup> *Id.* at 35.





*Figure 9: Designer Daan van den Berg imagined what would happen if you “infected” standard IKEA designs with the “Elephantiasis virus.”*

As with design patents, trade dress protection should not provide a significant barrier to the reproduction of objects with a 3D printer. If an element of the object is required for its operation, it cannot be protected by trade dress. However, attempts to exactly copy objects with trade dress protection will run afoul of trademark law.

## REMIXING

What about remixing? Remix culture has been one of the richest creative results of the widespread availability of networked computing. Traditionally, remix culture has been limited to written works, visual art, and music. However, there are already examples of remixers experimenting with functional objects. See *Figure 9*.

In some ways, 3D printing may usher in a new golden age of remix culture. Recall that the traditional sources of remixed works – written works, visual art, and music – are mostly protected by copyright. As a result, remix artists have needed to rely on fair use to create their works.

There are comparatively fewer intellectual property protections for tangible, everyday objects. Reappropriating and mashing up functional objects will, in general, trigger fewer intellectual property rights issues. However, when those issues are triggered, they will be harder to resolve. Unlike copyright, there is no fair use for patent. Repurposing a patented object, for whatever reason, is still a violation of the patent.

Thus far, this paper has largely considered how rightsholders would respond with existing intellectual property law if 3D printing became widespread overnight. However, 3D printing will not emerge overnight. It will slowly improve and creep into the mainstream. As this process occurs, there will be tens, if not hundreds, of small intellectual property skirmishes. These skirmishes will attempt to wed existing intellectual property protections to new realities, and in doing so will slowly change the state of the law. While it would be easy to miss these skirmishes – an obscure lawsuit here, a small amendment to the law there – it will be critical not to. In aggregate, these changes will decide how free we will be to use disruptive new technologies like 3D printing to their fullest potential. What follows is a list of the issues most likely to be fought over.

## PATENT

### EXPANSION OF CONTRIBUTORY INFRINGEMENT

Traditional patent infringement is not necessarily well suited to a world in which individuals are replicating patented items in their own homes for their own use. Unlike with copyright infringement, the mere possession or downloading of a file is not enough to create infringement liability.<sup>36</sup> In order to identify an infringer, the patent owner would need to find a way to determine that the device was actually replicated in the physical world by the potential defendant. This would likely be significantly more time and resource intensive than the monitoring of file trading sites used in copyright infringement cases.

In light of this, following in the wake of large copyright holders, patent owners may turn to the doctrine of contributory infringement to defend their rights.<sup>37</sup> This would allow patent owners to go after those who enable individuals to replicate patented items in their homes. For example, they could sue manufacturers of 3D printers on the grounds that 3D printers are required to make copies. They may sue sites that host design files as havens of piracy. Instead of having to sue hundreds, or even thousands, of individuals with limited resources, patent holders could sue a handful of companies with the resources to pay judgments against them.

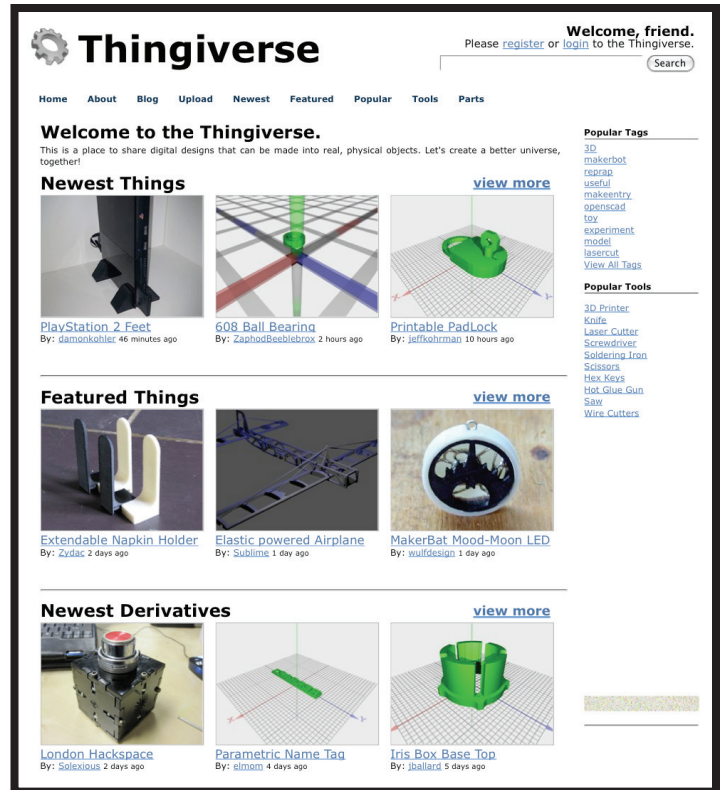


Figure 10: Communities such as Thingiverse (<http://www.thingiverse.com>) already exist to allow designers to share, discuss, and collaborate on designs.

In addition to attacking the companies that make 3D printing possible, patent owners may try to stigmatize CAD filetypes in much the same way that copyright holders stigmatize the bittorrent file transfer protocol (or even MP3 files). Successfully equating CAD files with infringement could slow the mainstream adoption of 3D printing and imply that anyone uploading CAD files to a community site is somehow infringing on rights.

### Evidence of Copying

However, contributory infringement will not automatically give patent owners the ability to shut down 3D printing. First and foremost, contributory infringement still requires evidence of actual infringement.<sup>38</sup> This should prevent patent owners from inferring that Company X must be helping people infringe

<sup>36</sup> When downloading a file, a user creates a copy of that file on her own hard drive, thus implicating copyright.

<sup>37</sup> See 35 U.S.C. 271 (c).

<sup>38</sup> See *Enpat, Inc. v. Microsoft Corp.*, 6 F.Supp. 2d 537, 538 (E.D. Va. 1998) (citing *Joy Technologies, Inc. v. Flakt, Inc.*, 6 F.3d 770, 774 (Fed.Cir. 1993)).

simply because of the nature of the product they offer. In order to successfully sue Company X, patent owners will have to prove that a user actually used a product or service offered by Company X to infringe, not just that a user could have done so. Contributory infringement gives patent holders a way to protect their patent without having to go after each and every individual who infringed, but they still have to find at least one individual who actually infringed the patent.

### Staple Article of Commerce

The second hurdle for patent holders will be the “staple article of commerce” doctrine. This doctrine recognizes that inventions are made out of things, and that things can be used to make more than just the invention. For example, just because you patent a new steel mechanism does not mean that you can sue all steel manufacturers for contributory patent infringement. Even if someone did use a specific steel manufacturer’s steel to copy your mechanism, that fact alone would not allow you to sue for infringement. Steel has substantial lawful as well as unlawful uses, and the mere fact that it could be misused does not prove that it was misused.<sup>39</sup>

As long as an item is capable of substantial noninfringing uses, the fact that it could be used to infringe a patent is not enough to create liability for its creator.<sup>40</sup> Moreover, selling general-purpose equipment that can perform a process does not infringe on a patent on that process.<sup>41</sup> When the Supreme Court considered the fate of the VCR, it specifically borrowed this concept from patent law.<sup>42</sup>

This rule is logical. Tools like scanners and barcode readers are no doubt used in a number of patented processes – however, they are also used in any number of non-patented ways.<sup>43</sup> Similarly, a computer, a 3D printer, and some glue have the ability to make an infringing reproduction of a patented product. However, all of these items have so many legal and noninfringing uses that outlawing them would harm society.

### Knowledge

Finally, in order to sue a company who provides tools that can be used to infringe patents, a patent owner must show that the company knew or had the intent to cause someone else to infringe a patent.<sup>44</sup> Although a patent owner does not need to uncover direct evidence of intent to contribute to infringement, the patent owner does need to provide circumstantial evidence.<sup>45</sup> The patent holder must show that the party who allegedly induced infringement actually knew of the patent in question, or displayed deliberate indifference to the existence of such a patent.<sup>46</sup>

As with the other hurdles, this should serve to insulate the companies who merely provide the tools necessary to make 3D printing possible. The printer manufacturer, software designer, and companies that provide the materials that the printers use to make products should be able to claim that they are servicing a large, legitimate market and that any infringement is incidental to their activities.

### REPAIR AND REPRODUCTION

Today the public is free to replicate unpatented elements of combination patents. They can repair and replace worn elements without securing an additional license or obtaining necessary replacement parts from the original manufacturer.

When creating those replacement parts or unpatented elements becomes easier, manufacturers will likely begin to see it as piracy and theft. They will likely seek to criminalize the creation of replacement parts without a license and reduce the threshold for what qualifies as a step towards infringement. This will most likely come in the form of a push for an expanded scope for patent protection (especially design patents), and the creation of some sort of protections for non-patented elements of combination patents.

<sup>39</sup> See, e.g. *Metro-Goldwyn-Mayer Studios, Inc. v. Grokster, Ltd.*, 545 U.S. 913, 932-33 (2005) (*Grokster*).

<sup>40</sup> See *In re Bill of Lading Transmiss. & Processing Sys.*, 695 F. Supp.2d 680, 686-87 (S.D.O.H., 2010). See also *Sony Corp of America v. Universal City Studios, Inc.*, 464 U.S. 417, 442 (1984).

<sup>41</sup> See *Ricoh Co., Ltd. V. Quanta Computer Inc.*, 550 F.3d 1325, 1334 (Fed. Cir. 2008).

<sup>42</sup> See *Sony* at 442.

<sup>43</sup> See *In Re Bill of Lading* at 687.

<sup>44</sup> See *SEB S.A. v. Montgomery Ward & Co.*, 594 F.3d 1360, 1376 (Fed. Cir. 2010).

<sup>45</sup> See *DSU Medical Corp. v. JMS Co., Ltd.*, 471 F.3d 1293, 1306 (Fed. Cir. 2006).

<sup>46</sup> See *SEB S.A.* at 1377.



Also, the somewhat ambiguous line between repair and reconstruction is likely to be explored, and potentially clarified. Users will fight to maintain the right to repair worn out parts, while manufacturers will fight to create a monopoly on replacements.

## COPYRIGHT

As 3D printing makes it possible to recreate physical objects, manufacturers and designers of such objects will increasingly demand “copyright” protection for their functional objects. The most likely way to achieve this type of protection is to eliminate or restrict the application of the severability test discussed above. Instead of separating design elements from functional elements, they will work to expand copyright protection to all functional items that contain design elements. We are already seeing such attempts in the call for fashion copyright, or a desire to protect functional objects such as a Dyson vacuum or an iPod as art. In some ways, this fear was realized when Congress added a special copyright protection for boat hull designs.<sup>47</sup>

This could create a type of quasi-patent system, without the requirement for novelty or the strictly limited period of protection. Useful objects could be protected for decades after creation. Mechanical and functional innovation could be frozen by fears of massive copyright infringement lawsuits. Furthermore, articles that the public is free to recreate and improve upon today (such as a simple mug or bookend) would become subject to inaccessible and restrictive licensing agreements.

## TRADEMARK

In recent years, the Supreme Court has been protective of the public's interest in competition in the face of requests from trademark holders to increase the scope of protection. However, manufacturers will continue to seek expanded scope of trademark protection.<sup>48</sup> Trademark is an especially attractive type of protection because it is potentially infinite in time.

With regard to trade dress, manufacturers will continue to push for “inherent distinctiveness” (or automatic trademark protection) without a requirement that a design acquire distinctiveness through public association. They will also seek to minimize the importance of the “use in commerce” clause in trademark law. At this time, “use in commerce” has not been heavily

litigated because there were very few circumstances in which a defendant would be able to claim that they were not using the mark in commerce. As it becomes easier for individuals to create products at home for their own use, we can expect that to change.

The amorphous doctrine of trademark dilution is another candidate for possible expansion in scope. Unlike traditional trademark, a use that dilutes a “famous mark” does not need to be in commerce, confuse consumers, or cause direct economic harm to the markholder. Whether or not a mark qualifies as sufficiently “famous” for dilution protection is determined by the application of a nonexclusive list of eight separate factors defined in the statute.<sup>49</sup> This would give the courts wide latitude to gradually expand what marks qualify as famous for the purposes of dilution.

## EXPANSION OF LIABILITY

One of the major lessons of the digital copyright battles is that it can be hard, expensive, and time consuming to find and prosecute individual infringers. In response, rightsholders have increasingly sought out ways to expand liability beyond infringers to those who facilitate such infringement.<sup>50</sup> As this effort expands further from infringing material, it becomes increasingly destructive: all computers can make copies, but if computer manufacturers and networking companies are held liable for every movie illegally downloaded from the Internet, the companies would quickly go out of business and the Internet would slow from a superhighway to a unpaved country lane.

The same will be said for 3D printing. Sophisticated 3D printers will be able to reproduce patented items, protected trade dress, and even ornamental objects protected by copyright. However, if rightsholders are allowed to hold the companies that make 3D printing possible liable for copies that individuals make, they will be unable to continue operating. If rightsholders are able to force 3D printing companies to forfeit a percentage of their sales as “compensation,” or to incorporate restrictive copy controls, the industry may very well stall before it reaches a mass market audience.<sup>51</sup> For example, rightsholders could insist that, in order to avoid liability, 3D printer manufacturers incorporate restrictive DRM that would prevent their printers from reproducing CAD designs with “do not copy” watermarks.

<sup>47</sup> 17 U.S.C. § 1301 et al.

<sup>48</sup> See, e.g. Wal-Mart Stores; Traffix Devices.

<sup>49</sup> 15 U.S.C. § 1125 (c)(1)(A-H).

<sup>50</sup> See, e.g. Grokster.

<sup>51</sup> See, e.g. 17 U.S.C. § 1001 – 1010.

# CONCLUSION

The ability to reproduce physical objects in small workshops and at home is potentially just as revolutionary as the ability to summon information from any source onto a computer screen. Today, the basic outlines of this revolution are just starting to come into focus: 3D scanners and accessible CAD programs to create designs. Connected computers to easily share those designs. 3D printers to bring those designs into the real world. Low-cost, easy to use, accessible tools will change the way we think about physical objects just as radically as computers have changed the way we think about ideas.

The line between a physical object and a digital description of a physical object may also begin to blur. With a 3D printer, having the bits is almost as good as having the atoms. Information control systems that are traditionally applied to digital goods could start to seep out into the physical world.

The basic outlines of this revolution have not yet been filled in. In many ways, this is a gift. Setting the tools free in the world will produce unexpected outcomes and unforeseeable changes. However, the unknowable nature of 3D printing's future also works against it. As incumbent companies begin to see small-scale 3D printing as a threat, they will inevitably attempt to restrict it by expanding intellectual property protections. In doing so they will point to easily understood injuries to existing business models (caused by 3D printing or not) such as lost sales, lower profits, and reduced employment.

While thousands of new companies and industries will bloom in the wake of widespread 3D printing, they may not exist when the large companies start calling for increased protections. Policymakers and judges will be asked to weigh concrete losses today against future benefits that will be hard to quantify and imagine.

That is why it is critical for today's 3D printing community, tucked away in garages, hackerspaces, and labs, to keep a vigilant eye on these policy debates as they grow. There will be a time when impacted legacy industries demand some sort of DMCA for 3D printing. If the 3D printing community waits until that day to organize, it will be too late. Instead, the community must work to educate policy makers and the public about the benefits of widespread access. That way, when legacy industries portray 3D printing as a hobby for pirates and scofflaws, their claims will fall on ears too wise to destroy the new new thing.